

Interaction effects of vegetables in association with two years old *Hopea odorata* sapling

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Abstract: An experiment was carried out at the Agroforestry Farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh, during November 2008 to March 2009 to evaluate the growing performance of five vegetables viz, stem amaranth (*Amaranthus lividus*), red amaranth (*Amaranthus gangeticus*), Palangshakh (*Bengal spinach*), Kalmishakh (*Swamp cabbage*) and Indian spinach (*Basella aloha*) grown under two years old Telsur (*Hopea odorata*) saplings at different distance. Influence of vegetables on the growth parameters of Telsur (*Hopea odorata*) also determined. The five vegetables were laid out using a Randomized Complete Block Design (RCBD) with three replications as separate experiment. In each experiment vegetables are grown at different distance from tree base which were treated as different treatment. Performance of vegetables in terms of morphological parameters as well as yield was influenced significantly by the distance from the tree. The result showed that production of all vegetables was gradually increased with increasing distance from tree base. Highest production was recorded in control condition (without tree) which was significantly similar with 3 and 4 feet distance from the tree base and the lowest was observed under 1 feet distance which was almost similar with 2 feet distance. The growth characteristics of Telsur (*Hopea odorata*) significantly influenced by the five vegetables. The highest growth was recorded in control condition which was statistically similar with sapling-red amaranth, Palangshakh, Kalmishakh and Indian spinach combination. The lowest tree growth was found under the combination of sapling- stem amaranth combination.

Key words: Agroforestry practice, vegetables, interaction, *Hopea odorata*.

Introduction

Bangladesh has a total land area of 24 million hectare of which 14.3 million hectare is under forests (BBS, 2006). Every year the country is badly affected by the adverse environmental disasters, such as drought, extreme temperature, flood, tornado, and other natural hazards. For achieving rapid progress of civilization, forest is destructed; urban areas are expanded; industries are erected and environment is being polluted with harmful and noxious materials. All these activities done by man have led to a widespread exploitation of environment causing almost unrecoverable damage to it.

A survey conducted by USAID and CIDA revealed that 50 percent of the forest of Bangladesh has been destroyed during the last two decades and per capita forest is 0.01 hectare, which is the lowest in the world (BCES, 1997). However, according to the Forestry Master Plan and surveys by multilateral donor agencies, a total of 769,000 hectares (6%) of the country's landmass have actual tree coverage (BCES, 1999). But, to cope with the environmental crisis and enjoy the benefit of nature, we should have at least 25 percent forest coverage.

NGOs have added a new dimension to forest management, which has ensured community participation and protection of the forest. BRAC social forestry program, launched in 1988, increases awareness about the necessity of planting trees in rural areas, creates a suitable supply of high quality seedlings, and reduces the adverse environmental effects of deforestation while creating income and employment opportunities for rural women.

Almost half of the population of Bangladesh is women. Therefore, development of the country is impossible without active participation of women. Green Hill Tree plantation project has taken some measures for inclusion of poor women in its forestry and development program under the banner of social forestry, women and development. The present study is an effort to increase

forest coverage and sound environment with agroforestry practices.

Materials and Methods

The experiment was carried out at the experimental farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh during the period from November, 2009 to March, 2010. The experimental site is geographically located at about 24°75' North latitude and 90°50' East longitudes (Khan, 1997). In this study five vegetables, such as stem amaranth (*Amaranthus lividus*), red amaranth (*Amaranthus gangeticus*), Palangshakh (*Bengal spinach*), Kalmishakh (*Swamp cabbage*) and Indian spinach (*Basella alha*) were grown in association with 2 years old Telsur (*Hopea odorata*) saplings. Each vegetable were laid using the Randomize Complete Block Design (RCBD) with three replications as separate experiment. Individual plot size was 9ft × 3ft. In each experiment vegetables are grown at different distance from tree base which were treated as treatment. For every experiments treatments were as; T₀= Open field (without trees)-control; T₁=1 feet distance from the tree; T₂= 2 feet distance from the tree; T₃= 3 feet distance from the tree and T₄= 4 feet distance from the tree; *Hopea odorata* sapling are also grown without vegetables association as control.

After land preparation all vegetables seed were directly sown in the experimental plot on 20th November 2008. Necessary cultural operations were done for all vegetables. Plant samples of stem amaranth, red amaranth, Palangshakh, Kalmishakh and Indian spinach were collected randomly from the respective plots. Twenty plants of each vegetables were selected from each plot for data collection. Plant height (cm), stem girth (cm), no. of leaves per plant, leaf length (cm) and fresh weight plant⁻¹(g) were recorded from selected plants of respective vegetables. Yield of all vegetables calculated from the fresh weight per plant as t/ha. Height (cm), girth (cm), leaf

size (cm²) and number of leaves per *Hopea odorata* sapling also measured during the harvesting period of vegetables.

Data regarding various parameters under study from the experiment were statistically analyzed by the computer using statistical package program MSTAT-C (Russell, 1986). Mean comparisons were done by DMRT (Duncan's Multiple Range Test) at 5% level of significance (Gomez and Gomez, 1984).

Results and Discussion

Influence of *Hopea odorata* sapling on the growth and yield of stem different vegetables:

Growth parameters: Different growth parameters of stem amaranth, red amaranth, Palangshakh, Kalmishakh and Indian spinach were significantly influenced by *Hopea odorata* sapling (Fig. 1) these were as:

Plant height: Height of all five tested vegetables was significantly influenced with increasing distance from tree

base (Table 1). Highest plant height each vegetable was observed under control condition which was statistically similar with the plant height observed at 4 feet distance from sapling base (Table 1). Lowest plant height was found at 1-2 feet distance from sapling base which is statistically similar with the plant height recorded at 3 feet distance from sapling base (Table. 1). It was found that plant height within 1-3 feet from sapling base was relatively shorter as compared with control condition other treatments i.e. more than 2 feet distance from tree base. This may be due to the competition for moisture and nutrients between the roots of *Hopea odorata* sapling and vegetables because sapling age was only two years, in this period, tree root can spread upto three feet distance. Similar type results were also observed by Dhukia *et al* (1988) and Islam *et al* (2008), they found that plant at closer distance from tree base has severely affected by the competition of tree root.

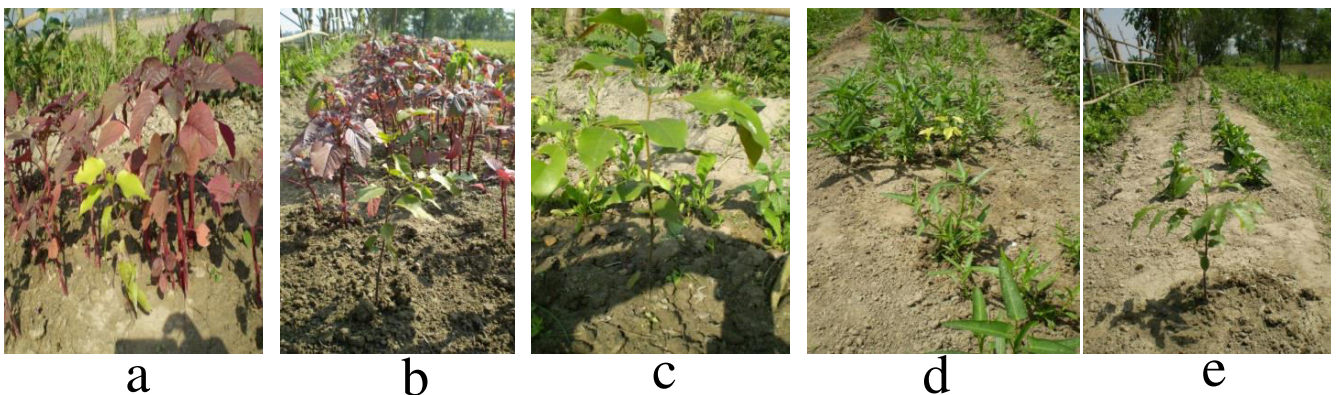


Fig.1. (a) stem amaranth, (b) red amaranth, (c) Palangshakh, (d) Kalmishakh and (e) Indian spinach in association with Telsur sapling

Stem girth: girth of *Amaranthus lividus*, *Amaranthus gangeticus*, *Bengal spinach*, *Swamp cabbage* and *Basella alba* stem were also significantly influenced with increasing distance from tree base (Table. 1). The trend variation almost similar with plant height as increasing distance, stem girth also increased, where highest stem girth recorded under control condition and lowest at 1-2 feet distance from saplings base. Stem girth of all experimental vegetables at 3-4 feet distance from saplings base were statistically similar with control condition. Near the sapling base i.e. closest to the saplings there was a negative interaction for moisture and nutrients between the roots of vegetables and *Hopea odorata* as a results stem girth in near distance from sapling was thin compare to far distance. Similar result was also reported by Ali *et. al.* (1998) and Islam *et. al.* (2008) they reported that the leaf

production stem girth gradually increased with increasing distance from the associated plants.

Leaf number and size: Number of leaves and length of vegetables were gradually increased with increasing distance from sapling base (Table 1). Among the different treatments large sized leaves were found at 4 feet distance and small sized at 1 feet distance (table.1). Leaf length at 2-3 feet distance from tree base statistically similar with 1 feet distant plants. Like leaf length, almost similar result also observed in case of leaf number. Near the sapling of *Hopea odorata* both leaf size and number of all vegetables were small and less, this may be due to the negative interaction between the roots of *Hopea odorata* and vegetables for moisture and nutrients.

Table 1. Influence of Telsur saplings to the growth and yield of stem amaranth, red amaranth, Palangshakh, Kalmishakh and Indian spinach

Treatments	Bengal spinach (Palangshakh)				Swamp cabbage (Kalmishakh)				Basella aloha (Indian spices)				Amaranthus lividus (stem amaranth)				Amaranthus gangeticus (red amaranth)				
	Plant Height (cm)	Stem girth (cm)	No. of leaves per plant	Leaf length (cm)	Plant Height (cm)	Stem girth (cm)	No. of leaves per plant	Leaf length (cm)	Plant Height (cm)	Stem girth (cm)	No. of leaves per plant	Leaf length (cm)	Plant Height (cm)	Stem girth (cm)	No. of leaves per plant	Leaf length (cm)	Plant Height (cm)	Stem girth (cm)	No. of leaves per plant	Leaf length (cm)	
T ₀	19.21a	3.13a	12.00a	11.41a	18.91a	3.00a	14.00a	7.84a	17.71a	3.03a	8.00a	8.80a	24.31a	3.77a	20.00a	13.50a	16.71a	2.00a	13.85a	8.40a	
T ₁	16.26c	2.80c	7.33c	8.63d	15.33c	2.70c	9.49c	5.84d	14.53c	2.74c	5.85d	6.26d	17.96c	3.28d	14.00d	10.18c	13.06c	1.77c	8.30c	7.01c	
T ₂	17.48b	2.91c	9.13b	9.62c	16.63b	2.85b	11.19b	6.64c	15.54c	2.83b	6.65c	7.16c	20.16b	3.48c	16.20c	11.39b	14.42b	1.82c	9.85c	7.66b	
T ₃	18.68a	3.01b	10.23b	10.60b	17.83a	2.94a	12.50b	7.22b	16.61b	2.91b	7.35b	8.00b	22.31a	3.63b	18.08b	12.39b	15.54b	1.91b	11.85b	7.82b	
T ₄	19.19a	3.11a	12.00a	11.39a	18.89a	3.00a	14.00a	7.82a	17.69a	3.00a	8.00a	8.75a	24.31a	3.71a	19.89a	13.48a	16.69a	2.00a	13.80a	8.36a	
Level of Significance	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
LSD	1.18	.091	1.741	0.74	1.13	.083	1.49	0.54	1.061	.085	0.61	0.72	2.05	0.101	1.74	1.02	1.131	0.082	1.93	0.52	

Yield: *Amaranthus lividus*, *Amaranthus gangeticus*, *Bengal spinach*, *Swamp cabbage* and *Basella alha* were significantly influenced by *Hopea odorata* sapling at closer distance from the base (Fig. 2). Lowest yield of vegetables were recorded at 1 feet distant area from the base of the sapling which were statistically similar 2 and 3 feet distances from sapling base. Yield at 4 feet distance

from sapling base were statistically similar with control condition (Fig. 2). During the early stage of plantation i.e. initial 2 years, competition for growth resources is occur upto 3 feet from the basal areas of sapling. For this reason some yield reduction of all five vegetables were observed near the basal area (1-3 feet distance) *Hopea odorata*.

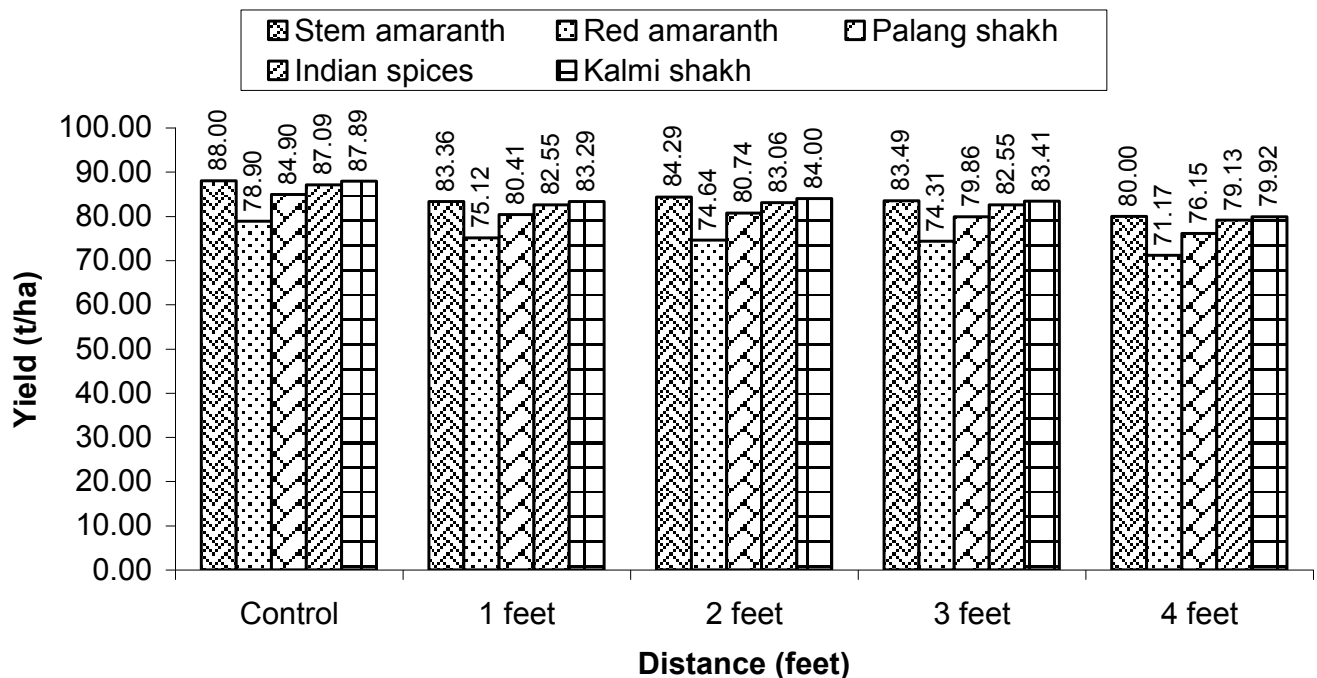


Fig.2. Yield of five vegetables in association with Telsur (*Hopea odorata*) trees

Effect of stem amaranth vegetables on the growth characteristics of Hopea odorata:

The growth characteristics such as plant height, stem girth, leaf numbers and leaf area of *Hopea odorata* significantly influenced by the interaction of stem amaranth (Fig. 3). Height, stem girth, leaf numbers and leaf area of *Hopea odorata* were significantly lower when it was in association with stem amaranth (Fig. 3). Among the five vegetables stem amaranth is the long time durable as well as large size vegetables and its root volume also large. For this reason competition may be dominant between *Hopea odorata* sapling and stem amaranth roots for growth

resources especially for nutrient and moisture as a result *Hopea odorata* was suppressed. Medium growth pattern were observed in association with *Bengal spinach* and *Basella alha* because these vegetables are medium durable. On the other hand, *Amaranthus gangeticus* and *Swamp cabbage* were short durable and small in size as a result in association in these vegetables *Hopea odorata* growth was almost similar with control condition upto 2 years period of *Hopea odorata* saplings.

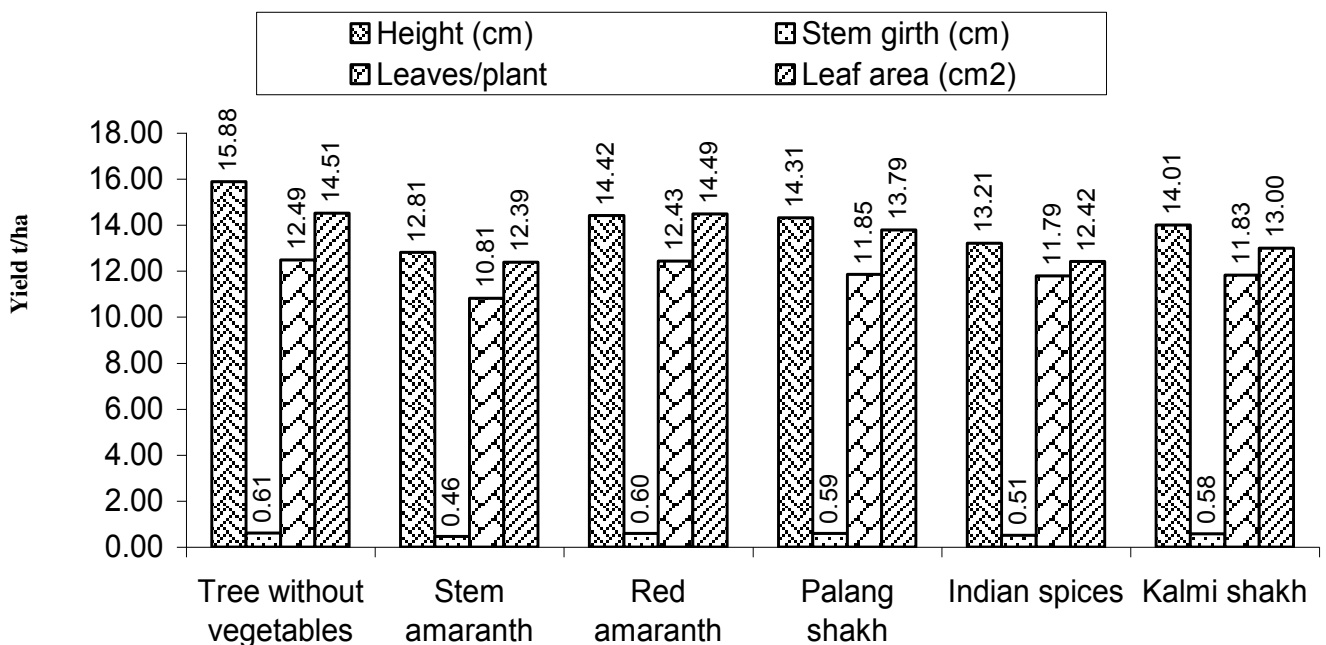


Fig. 3. Effect of vegetables the growth characteristics of Telsur (*Hopea odorata*) saplings

Hopea odorata growth was comparatively lower in association with stem amaranth, moderate in *Swamp cabbage* and *Basella alba* than others i. e., *Amaranthus gangeticus* and *Bengal spinach*. Yield of all vegetables were significantly lower with in the 1-3 feet distance from tree base i. e., 1.5 to 2 years of *Hopea odorata* plantation all five vegetables can be grown successfully more than 3 feet distance from tree base.

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